Serial No. 10/678,417
December 20, 2005
Reply to the Office Action dated September 20, 2005

REMARKS/ARGUMENTS

Claims 12 and 14-19 are pending in this application. By this amendment, Applicants amend claim 12.

Claims 12 and 14-19 were rejected under 35 U.S.C. § 112, second paragraph, for allegedly being indefinite. Applicants have amended claim 12 to correct the informality noted by the Examiner. Accordingly, Applicants respectfully request reconsideration and withdrawal of this rejection.

Claim 12 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Higgins, III (U.S. 5,583,377) in view of Suzuki (U.S. 6,028,358). Claim 14 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Higgins, III in view of Suzuki, and further in view of Li (U.S. 5,982,621). Claims 15-19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Higgins, III in view of Suzuki, and further in view of Li (U.S. 5,982,621). Applicants note that although the Examiner indicated that claim 14 was rejected over Higgins, III in view of Suzuki, and further in view of Li, it appears that the Examiner intended to reject claim 14 over Higgins, III in view of Suzuki, and further in view of Jamieson et al. (U.S. 6,060,777) because the Examiner referred to Jamieson et al. in the rejection, and did not refer to Li. Applicants respectfully traverse the rejections of claims 12 and 14-19.

Claim 12 has been amended to recite:

> "A process for fabricating an integrated circuit package, comprising:
>
> providing a substrate having opposing first and second surfaces and conductive traces extending therebetween, the substrate having a cavity therein;
>
> **fixing a heat slug in the form of a substantially flat plate to said first surface of said substrate, such that said heat slug spans said cavity**;
>
> mounting a semiconductor die to said heat slug, at least a portion of said semiconductor die being disposed in said cavity;
>
> wire bonding said semiconductor die to ones of said conductive traces at said second surface of said substrate;
>
> encapsulating said wire bonds and said semiconductor die in an encapsulating material; and

> forming a ball grid array on said first surface of said substrate such that bumps of said ball grid array are in electrical connection with ones of said conductive traces; wherein
>
> **the heat slug is fixed to the first surface of the substrate on which said ball grid array is formed.**" (emphasis added)

The Examiner alleged that Higgins, III teaches all of the features recited in Applicants' claim 12, except for a heat slug in the form of a substantially flat plate. The Examiner further alleged that Suzuki teaches "spanning the opening cavity with a heating slug 4 in the form of a plate having a base portion of heat sink plug extending below circuitized substrate, and also teaches and show at Figure 3 (second embodiment; col 5, lines 39-55; Figs 7-8; col 6, line 45 through col 7; Fig 9, col 7, lines 15-24) spanning the opening cavity with a heating slug 13 in the form of a substantially flat plate."

Thus, the Examiner concluded that it would have been obvious "to fixing the heat slug in the form of the plate of Higgins to the substrate by alternatively employing the heat slug in the form of a substantially flat plate as shown and prima facie taught by Suzuki, wherein Suzuki prima facie teaches forming a heating slug 13 in the form of a substantially flat plate (see Figure 3) instead of using the heat slug 4 having sidewalls and flanges as shown in Figure 1A of Suzuki. This is because these heat slugs are alternative and art recognized equivalent for substitution, wherein a semiconductor device package having the flat heat slug is planar, and wherein a plurality of semiconductor device packages having the flat heat slugs can be effectively stacked together so as to form stacked devices." Applicants respectfully disagree.

In the Response to Arguments section on pages 5 and 6 of the outstanding Office Action, the Examiner alleged that "the combined references prima facie teaches the claimed invention. The metallic base heat slug 13 of Suzuki and thermal heat sink plate slug (e.g. 66/68 in Fig. 3) of Higgins are functioning as a heat sink as they are highly thermally conducted and thus removed heat from the chip (Higgins col 4, lines

55-60; col. 6, lines 41-67; Col 2, lines 58-67; and in Suzuki, see col 9, lines 14-24 and col 5, lines 45-50). This rejection is not overcome by pointing out that one reference does not contain a particular limitation when reliance for that teaching is on another reference."

It is clear from the Examiner's allegation that the Examiner has misinterpreted the arguments presented in the Amendment filed on August 16, 2005. In particular, Applicants did not present any arguments that one reference teaches or does not teach any specific feature recited in Applicants' claim 12. In contrast, Applicants argued that regardless of whether or not Suzuki teaches a heat slug in the form of a substantially flat plate, the fact that Higgins, III teaches away from such a heat slug, would preclude one of ordinary skill in the art from combining the teachings of Suzuki with Higgins, III. Therefore, Applicants respectfully submit that the Examiner has failed to establish a *prima facie* case of obviousness in the rejection of the claim 12.

In the paragraph bridging pages 5 and 6 of the outstanding Office Action, the Examiner alleged that "Higgins clearly teaches forming a heat sink attached to the substrate (col 2, lines 58 through col 3), wherein the heat sink establishes a continuous thermal path (col 4, lines 55-60; col 6, lines 39-67). Indeed, Higgins teaches (at Fig. 3) fixing a heat sink slug 66/68 in the form of a plate to the first surface of the substrate 62 such that the heat slug spans 66/68 the opening cavity 20, wherein the base portion of heat sink slug preferably extends below circuitized substrate; however, many benefits are achieved if the base portion is planar with the circuitized substrate. ... Herein, as of record, although Higgins teaches heat slugs including sidewalls and flanges, Higgins also teaches the base portion can be planar with the circuitized substrate."

It appears from the Examiner's allegations quoted above that the Examiner is alleging that Higgins, III teaches that the heat slug 66/68 could be in the form of a substantially flat plate simply because Higgins, III teaches that the base portion can be planar with the circuitized substrate. This is clearly incorrect.

Lines 12-17 of col. 6 of Higgins, III specifically disclose, "Common features of each heat sink include a base portion, sidewalls, and flanges. In particular, heat sinks 70, 90, and 100 have base portions 82, 92, and 102, respectively, sidewalls 84, 94, and 104, respectively, and flanges 86, 96, and 106, respectively." In other words, Higgins, III teaches that regardless of the location of the base portion of the heat sinks, the heat sinks **must** include a base portion, sidewalls and flanges.

Higgins, III neither teaches nor suggests that the heat sink could or should have any other configurations, other than ones including a base portion, sidewalls and flanges, and certainly fails to teach or suggest that the heat sink could or should be in the form of a substantially flat plate. Quite to the contrary, Higgins, III specifically teaches away from a heat sink that is in the form of a substantially flat plate, because Higgins, III specifically discloses that the heat sink must include **a base portion, sidewall and flanges**.

The Examiner is reminded that it is error to find obviousness where references diverge and teach away from the invention at hand. W.L. Gore & Assoc. v. Garlock Inc., 220 USPQ 303, 311 (Fed. Cir. 1983).

In addition, as argued in the Amendment filed on August 16, 2005, neither Higgins, III nor Suzuki teaches or suggests the feature of "the heat slug is fixed to the first surface of the substrate on which said ball grid array is formed" as recited in Applicants' claim 12. Applicants note that the Examiner has failed to specifically address this argument.

In contrast, Higgins, III clearly teaches that the heat sink is fixed to a surface that is different from the surface on which the ball grid array is formed. Particularly, the surface in Higgins, III to which the heat sink is fixed is either the surface opposite to the surface on which the ball grid array is formed or an intermediate surface such as that shown in Figs. 2 and 3 of Higgins, III. Higgins, III fails to teach or suggest that the heat sink could or should be fixed to any other surface of the substrate, and certainly fails to teach or suggest that the heat sink could or should be fixed to the same surface on which the ball grid array is formed. Thus, Higgins, III clearly fails to teach or suggest the feature of "the heat slug is fixed to the first surface of the substrate on which said ball grid array is formed" as recited in Applicants' claim 12.

Similarly, the metallic base substrate 13 of Suzuki, which the Examiner alleged corresponds to a heat sink, is clearly fixed to a surface opposite to the surface on which the ball grid array is formed (see, for example, Figs. 1A and 3 of Suzuki). Suzuki fails to teach or suggest that the metallic base substrate 13 could or should be fixed to any other surface of the substrate, and certainly fails to teach or suggest that the metallic base substrate 13 could or should be fixed to the surface on which the ball grid array is formed. Thus, Suzuki clearly fails to teach or suggest the feature of "the heat slug is fixed to the first surface of the substrate on which said ball grid array is formed" as recited in Applicants' claim 12.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection of claim 12 under 35 U.S.C. 103(a) as being unpatentable over Higgins, III in view of Suzuki.

The Examiner relied upon Li and Jamieson et al. to allegedly cure the clear deficiencies of Higgins, III and Suzuki. However, neither Jamieson et al. nor Li teaches or suggests the features of "fixing a heat slug in the form of a substantially flat plate to said first surface of said substrate, such that said heat slug spans said cavity" and "the heat slug is fixed to the first surface of the substrate on which said ball grid array is formed " as recited in Applicants' claim 12. Therefore, Applicants respectfully submit that Jamieson et al. and Li fail to cure the deficiencies of Higgins, III and Suzuki described above.

Accordingly, Applicants respectfully submit that Higgins, III, Suzuki, Jamieson et al. and Li, applied alone or in combination, fail to teach or suggest the unique combination of method steps and features recited in Applicants' claim 12.

In view of the foregoing amendments and remarks, Applicants respectfully submit that claim 12 is allowable. Claims 14-19 depend upon claim 12, and are therefore allowable for at least the reasons that claim 12 is allowable.

In view of the foregoing amendments and remarks, Applicants respectfully submit that this application is in condition for allowance. Favorable consideration and prompt allowance are solicited.

The Commissioner is authorized to charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 50-1353.

Respectfully submitted,

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